Development of Landscape Indicators for Potential Nutrient Impairment of Streams in EPA Region 8

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Region 8

Surface Waters (Rivers and Streams)

Population Estimates of Condition for an Area with known confidence

Ranking of Stressors

Association of Condition and Stressors

Landscapes

Predicted Conditions across an Area (WHERE?)

Association of Condition and Stressors

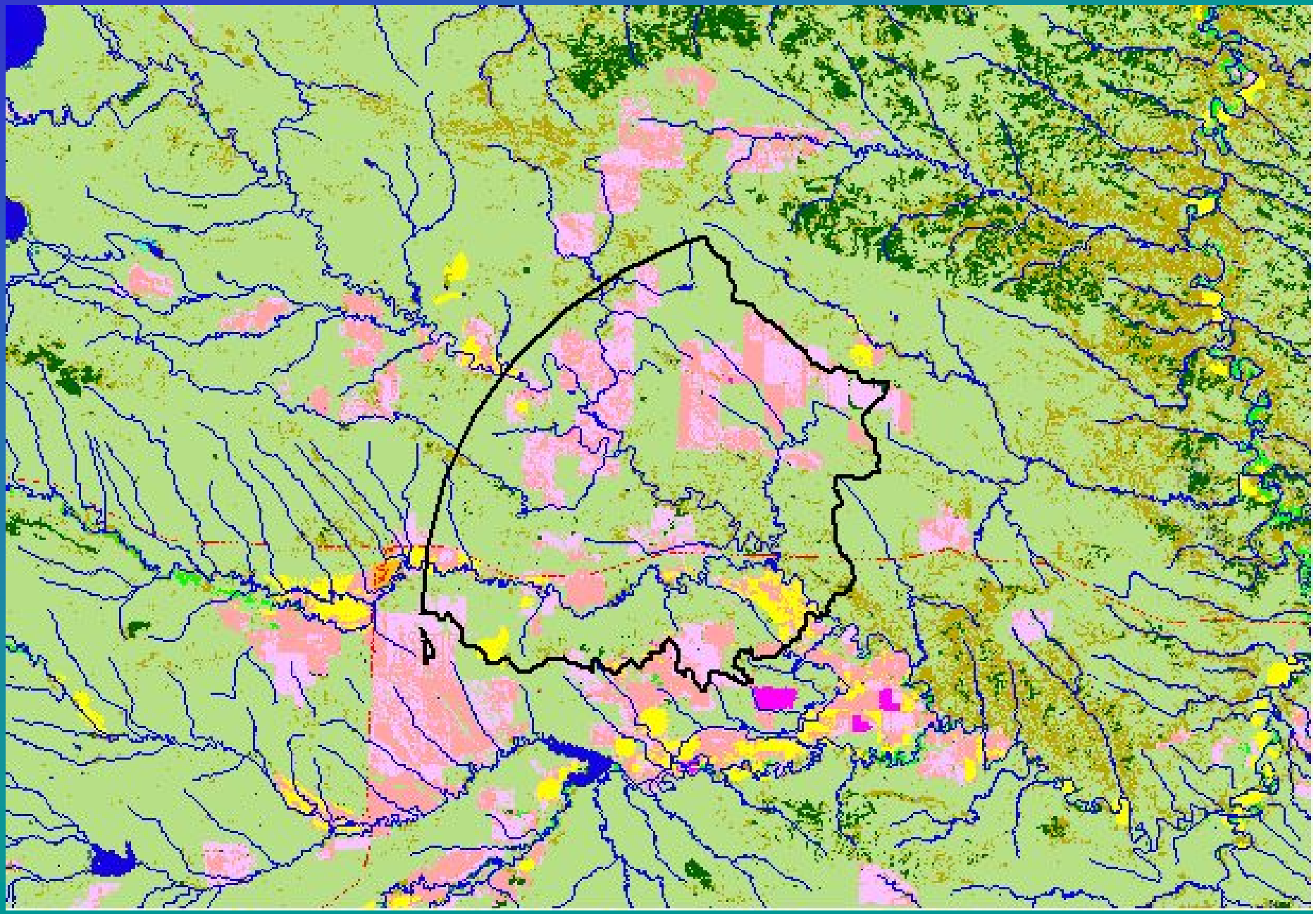
EMAP-West Landscape Indicator Concepts for Stream Condition

- **Ecological stream condition is often a function of the watershed composition and disturbance**

- **Many GIS data layers can be used to describe the watershed composition and disturbance**

- **Given an understanding of the relationship between condition and watershed composition and disturbance, models can be developed and applied to predict probable condition in other areas**

Land Cover and Streams in a Clipped Site Catchment



Landscape Analysis

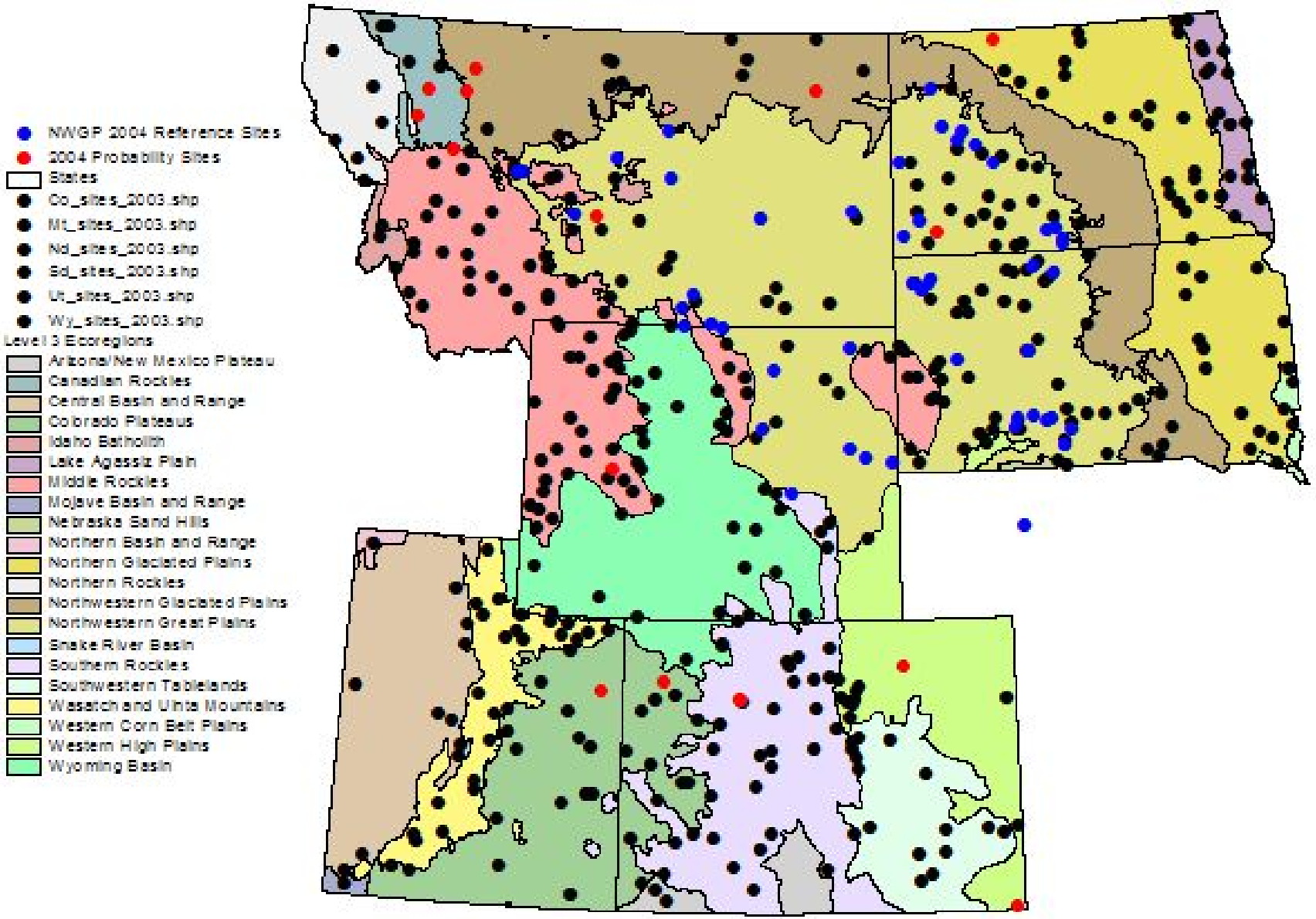
- ***Landscape Characterization***
  - **GIS Data Layers**
  - **Landscape Metrics**

- **Stream Condition and Stressor Association *Landscape Indicators***
  - **Generation of Catchments for Surface Water Monitoring Sites**
  - **Generation of Landscape Metrics for Catchments**
  - **Landscape Model Development**
  - **Landscape Model Application**

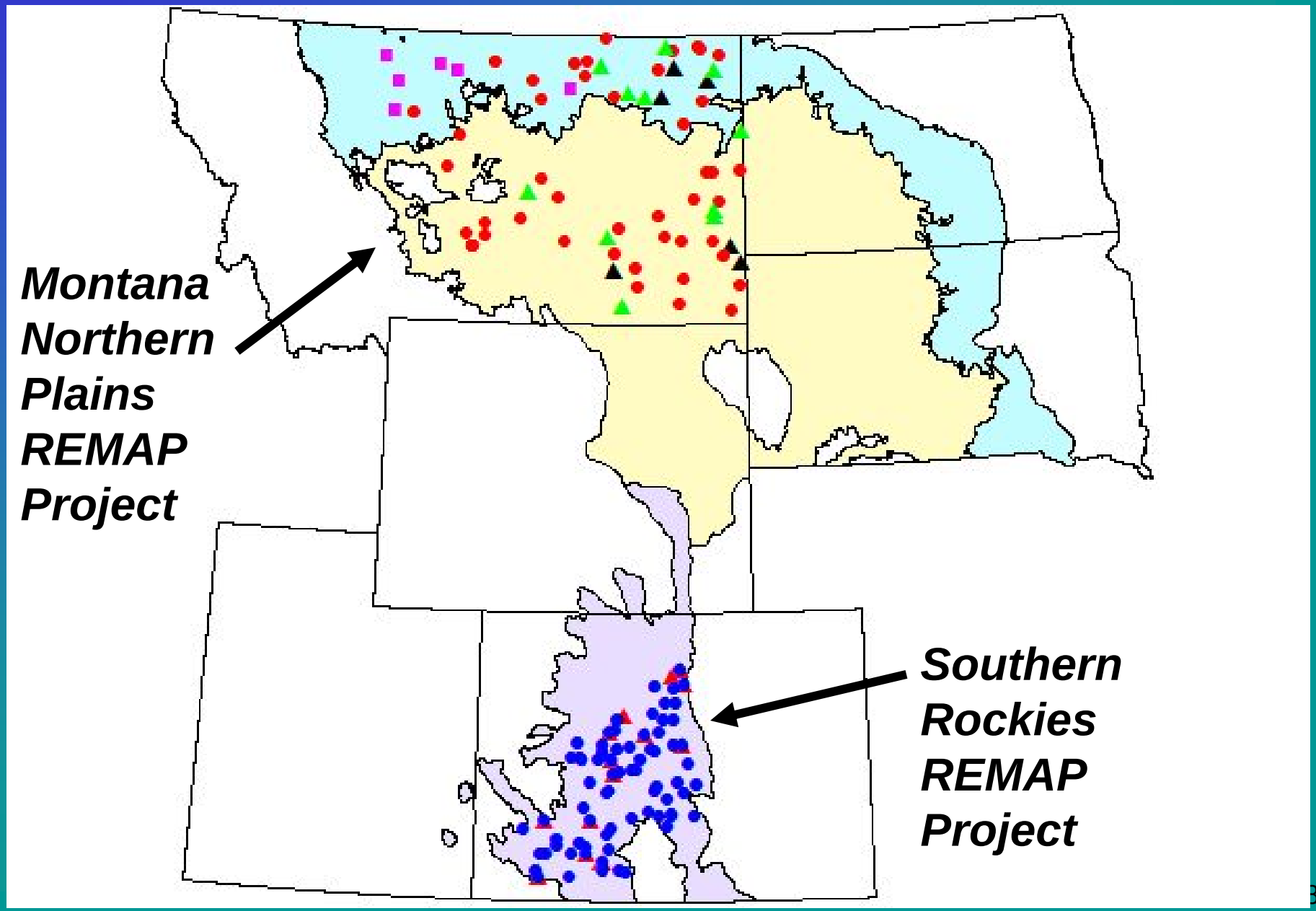
EMAP-West Landscape Data

- **Catchments for 2000, 2001, and 2002 Sites**
- **1992 National Land Cover Dataset (NLCD)**
- **National Hydrographic Dataset (NHD)** ***(RF3)***
- **Geographic Data Technology (GDT) Roads**
- **National Elevation Dataset (NED)**
- **STATSGO (NRCS Soils)**
- **EPA Ecoregions (Omernik Level 3)**
- **US Census Tiger 2000**
- **USDA Agricultural Census**
- **USGS GeoData (8-digit HUCS, Administrative, …)**
- **PRIZM, Geology, Mines, etc.**

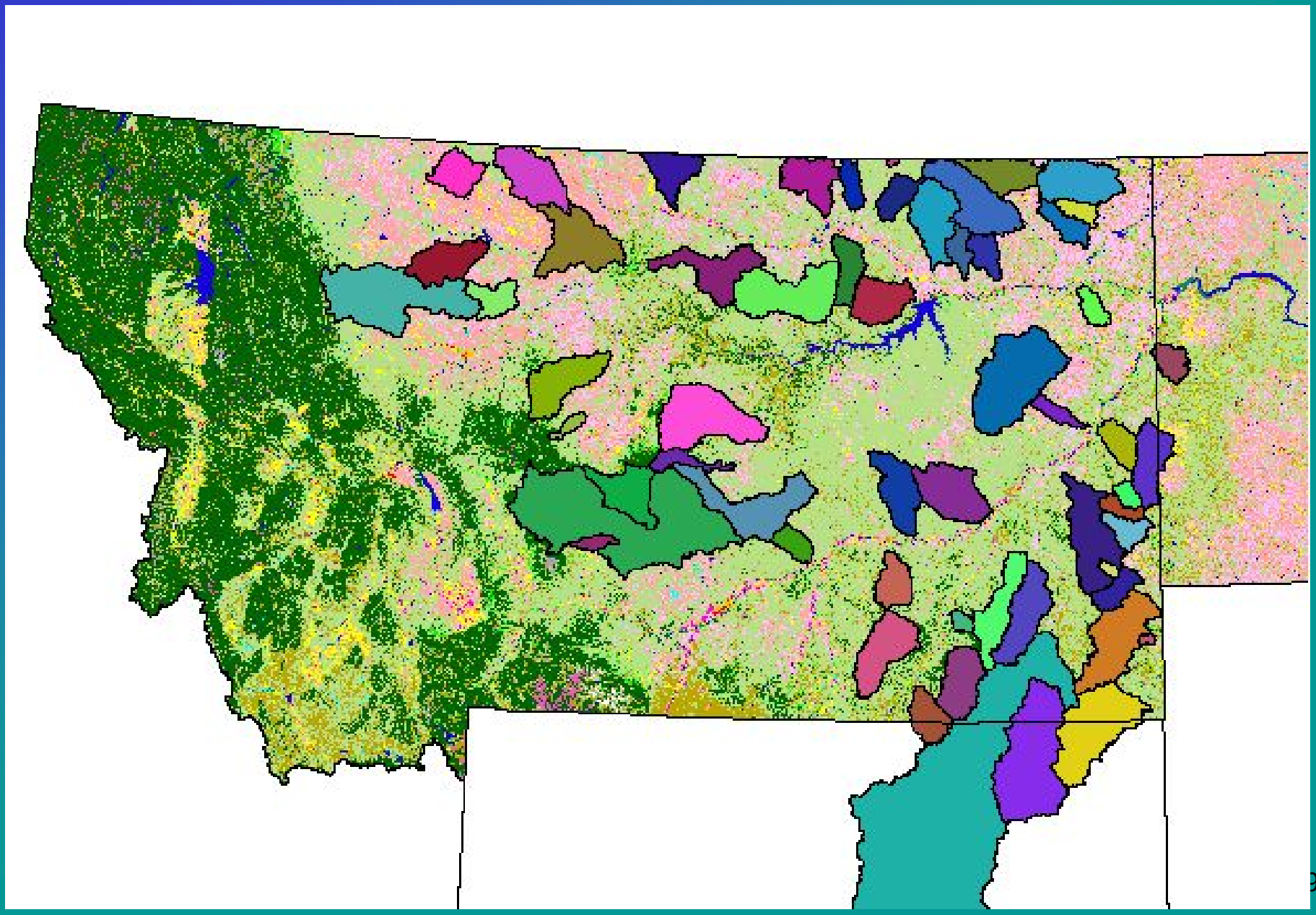
Region 8 EMAP-West Monitoring Status



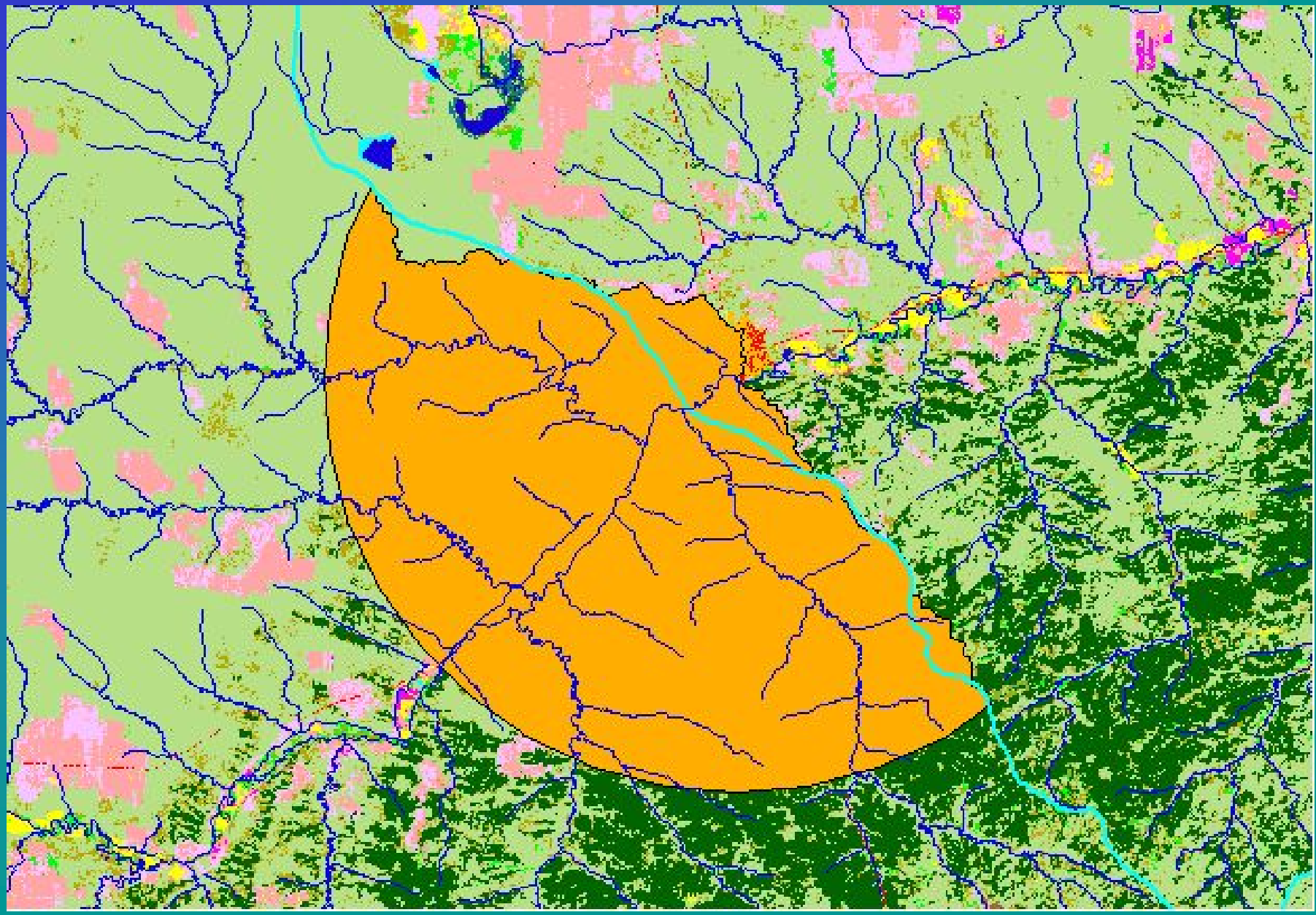
Montana Northern Plains and Southern Rockies



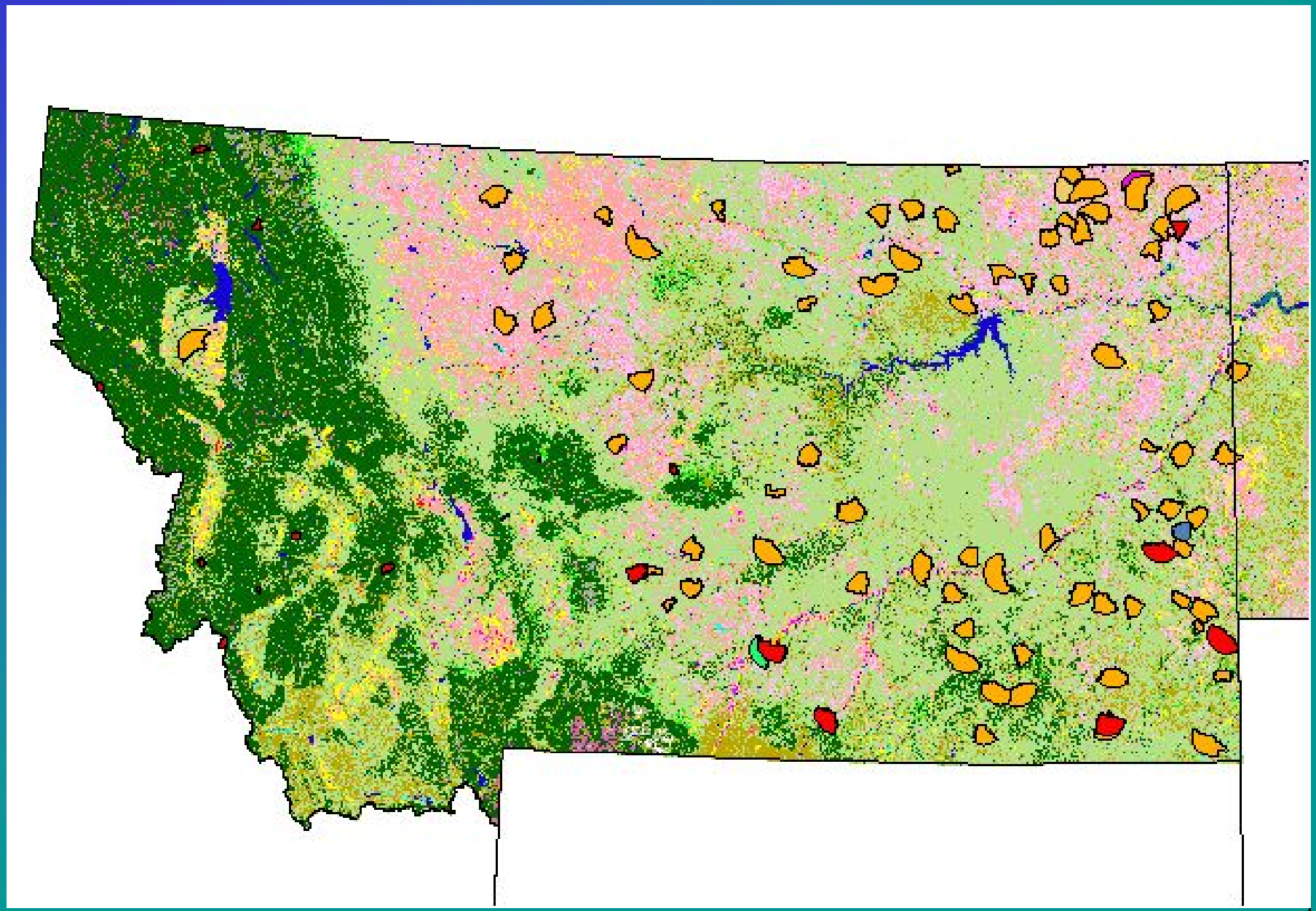
Full Catchments for MT Northern Plains Sites



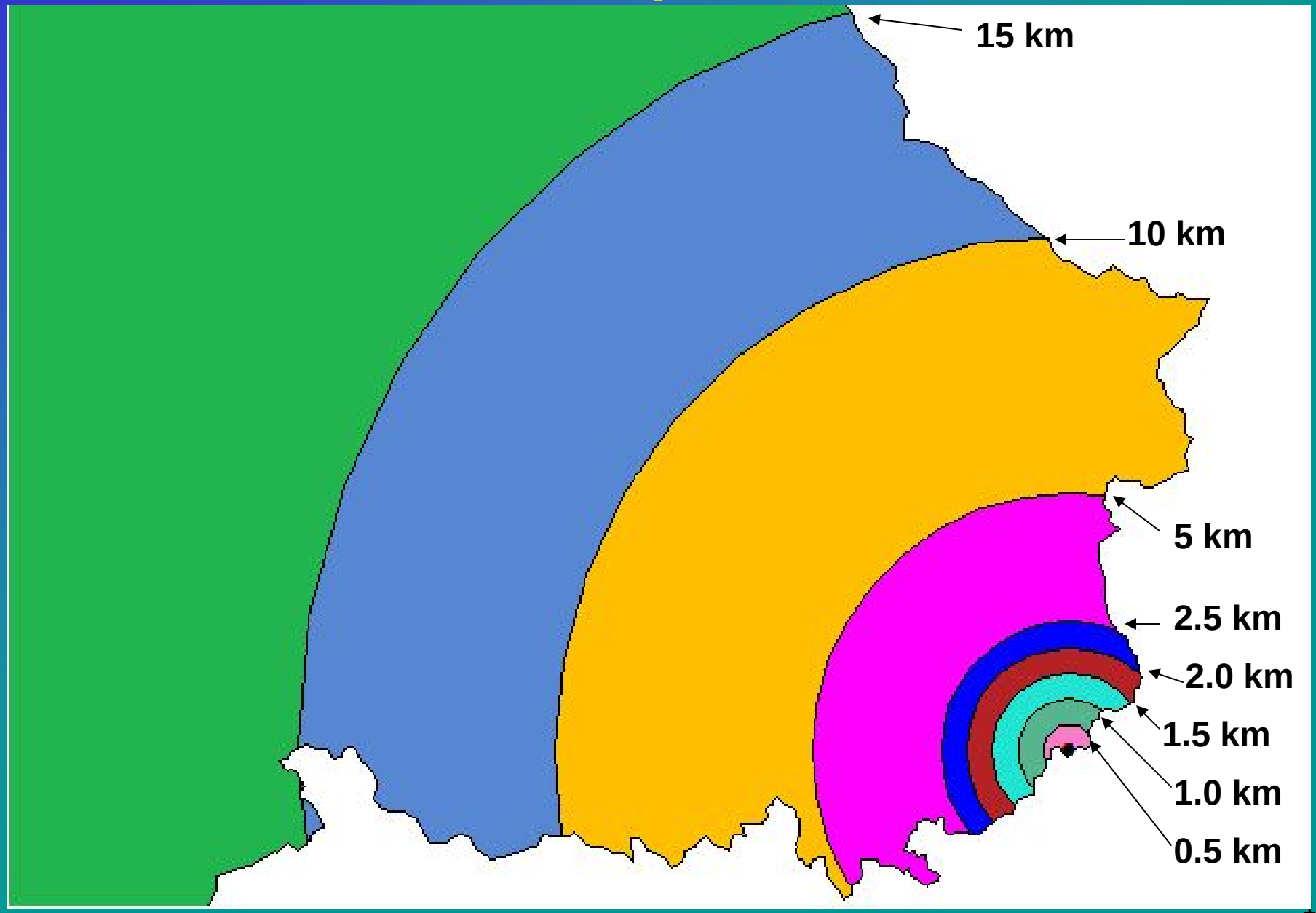
Catchment Definitions for EMAP-West



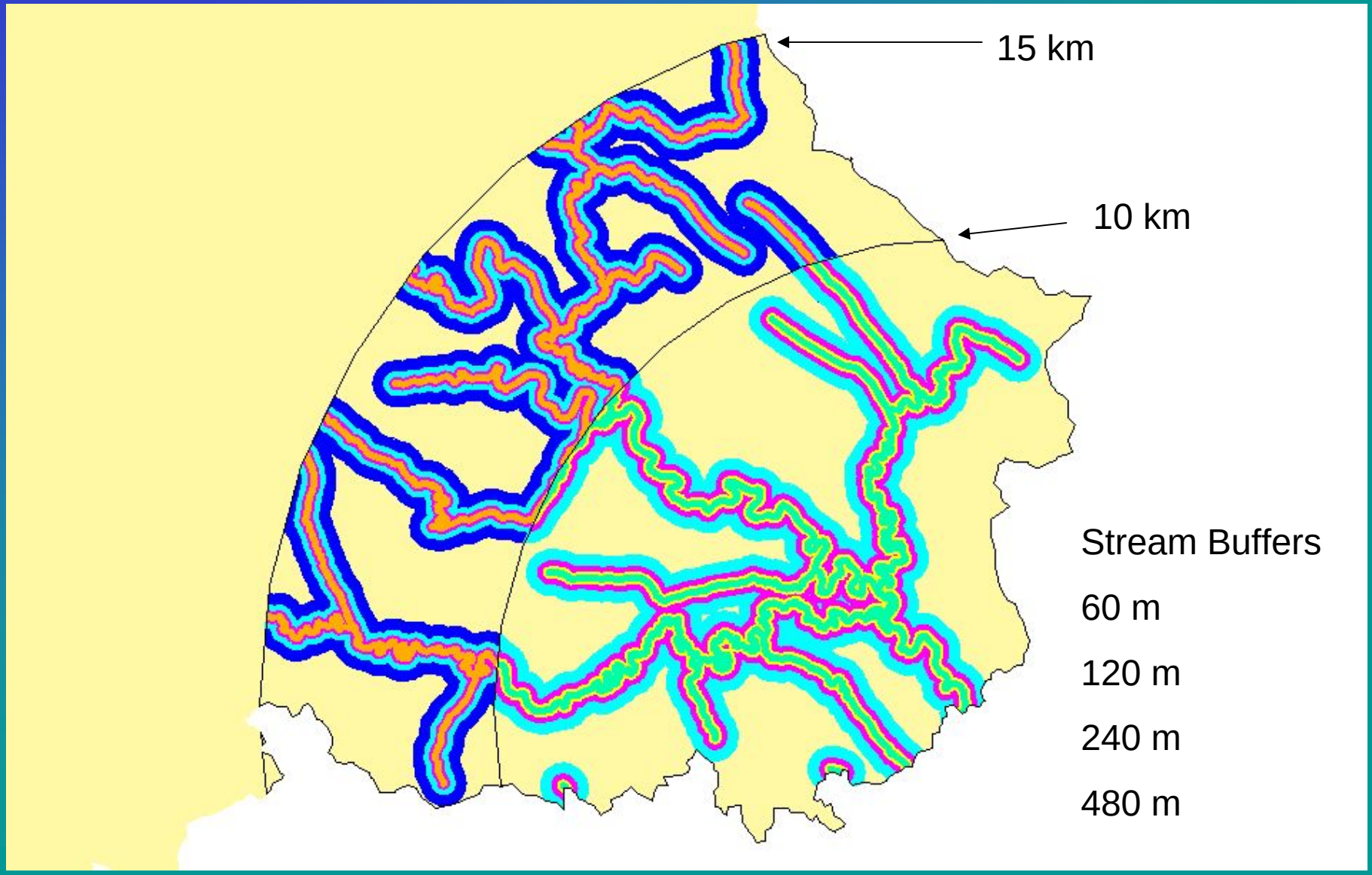
15 km clip of Montana Sites *(REMAP, 2000, and 2001)*



Distance from Site Clips



Buffer Distance from Stream are also Clipped with Distance from Sites



Landscape Indicator Development for Potential Nutrient Impairment

The Model Concept is that

Nutrient Concentrations are a function of:

- **Anthropogenic Influence**
  - **Land Cover Classes with Loading Factors**
    - **Road Class translation into Land Cover classes**
  - **Potential Grazing Impact**
- **Atmospheric Deposition** ***(modeled)***

Landscape Indicator Development for Potential Nutrient Impairment

- **Clipped and Buffered Catchments produced for EMAP-West 2000, 2001, MT Northern Plains and Southern Rockies REMAP Sites**
  - ***Catchments for EMAP 2002 Sites underway***

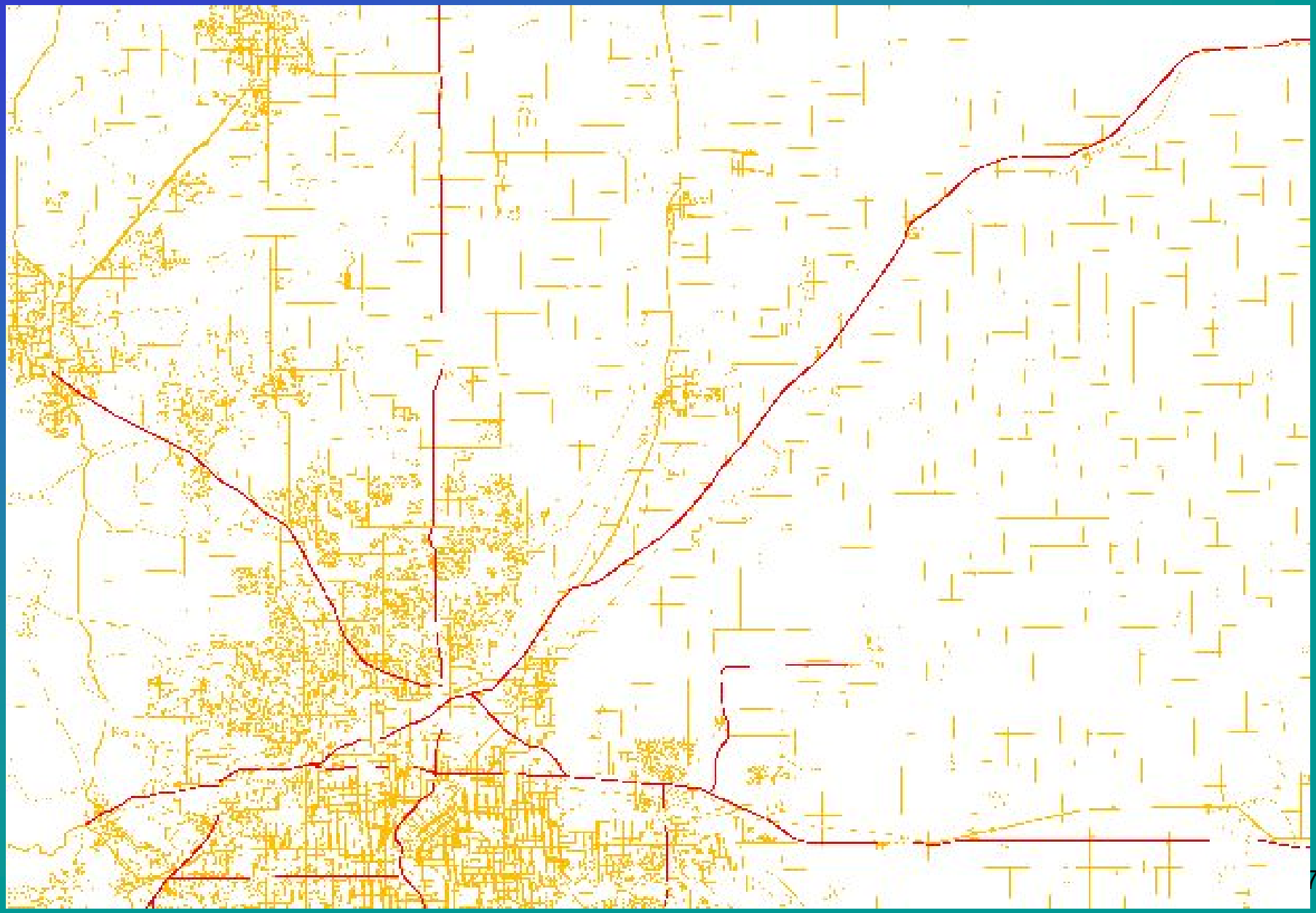
- **Modified Land Cover produced** ***(NLCD and Roads)***
- **Potential Grazing Impact** ***(Region-wide Model)***
- **Nitrogen Deposition Model** ***(acquired from OW)***

- **Landscape Metrics produced for catchments**
  - **PLOAD, NLOAD, and U_INDEX**
    - **From both NLCD and the modified NLCD (NLCD with roads)**
  - **Nitrogen Deposition**
  - **Potential Grazing Impact**

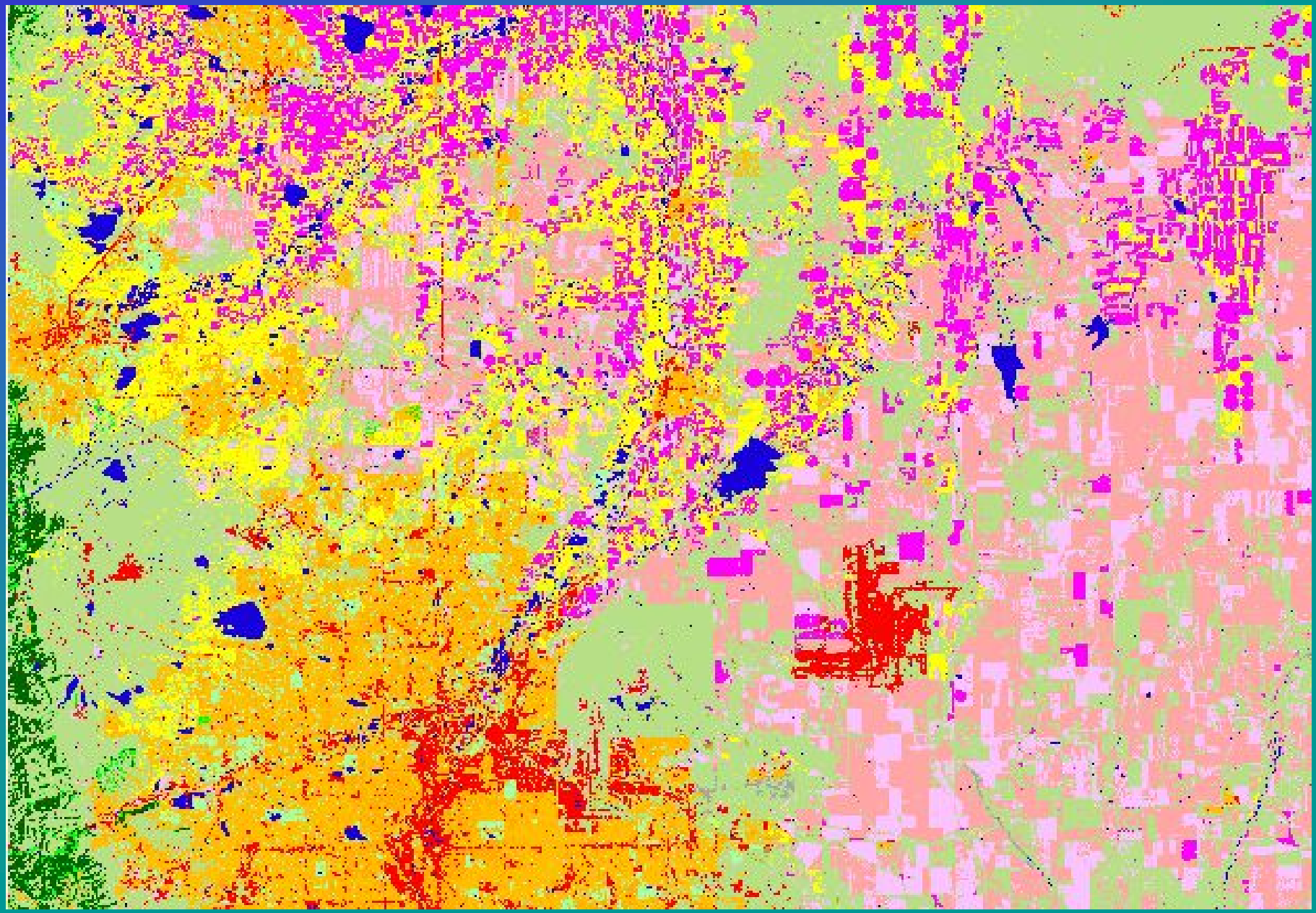
Development of the Modified National Land Cover Data (NLCD)

- **Conversion of Road Class to Land Cover Class (RD-NLCD)**
  - Generate separate Grids for each RD class
  - FCC A1x => NLCD 23 with 90m width
    - Interstate equivalents to commercial/transportation
  - FCC A2x => NLCD 21 with 90m width
  - FCC A3x => NLCD 21 with 30m width
  - FCC A4x => NLCD 21 with 30m width
  - Merge all Grids into one RD-NLCD grid
    - NCLD 23 class has priority
- **Combine NLCD with RD-NLCD**
  - Urban classes take priority

Roads reclassified in Land Cover Classes



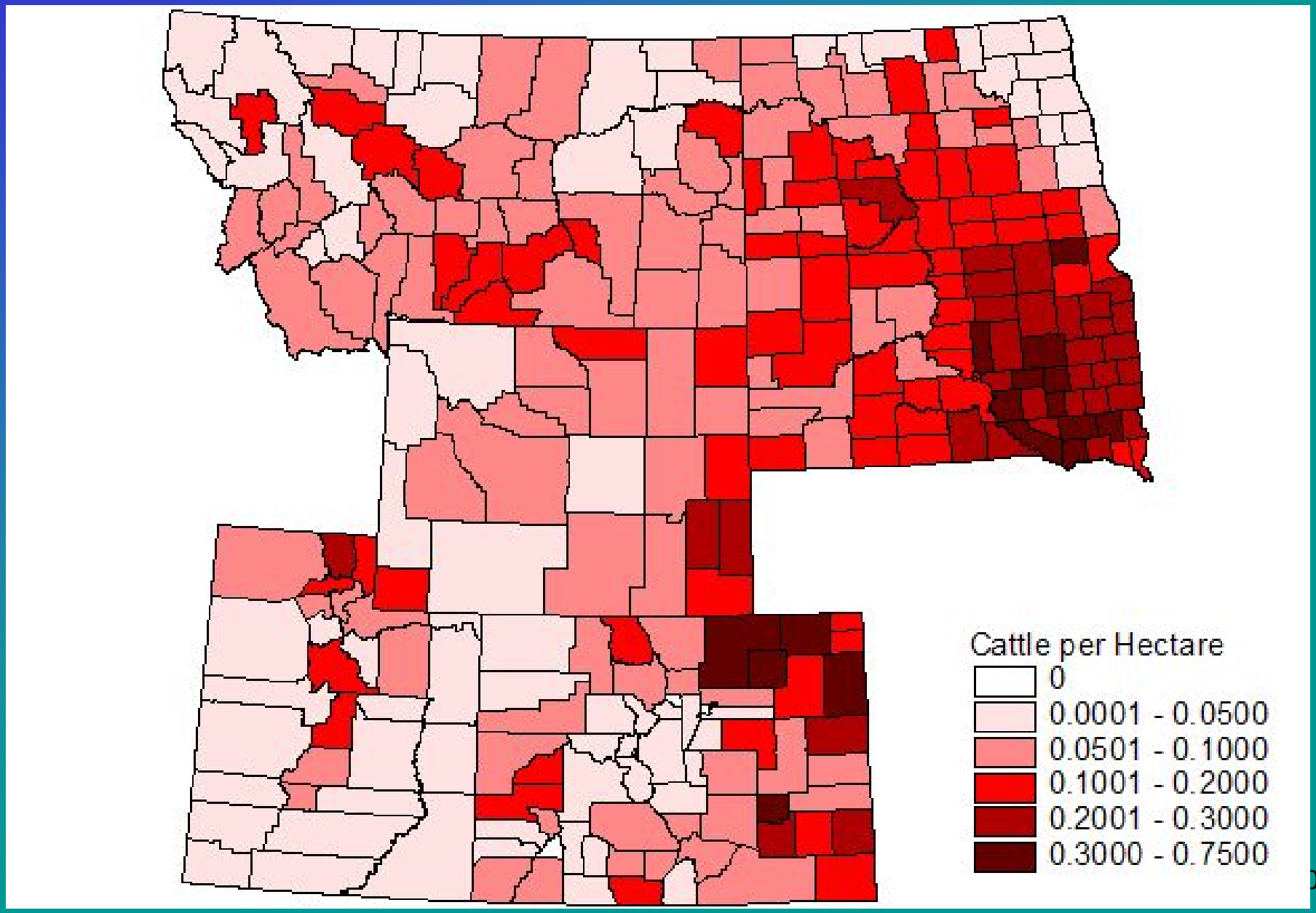
The NLCD classes for the same area



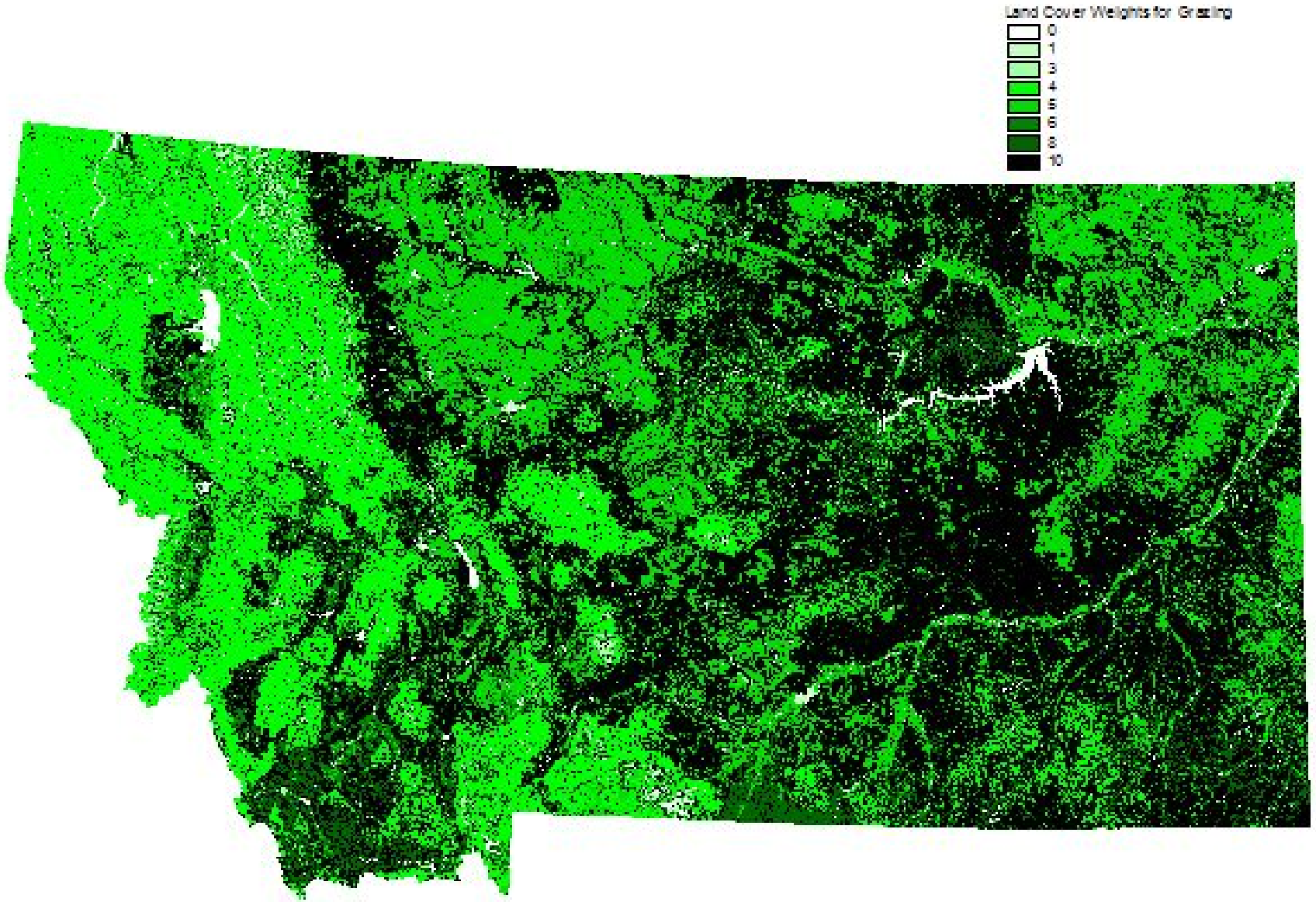
Development of the Potential Grazing Impact Model

- **Model inputs are:**
  - **Weighted Land Cover**
  - **Weighted Administrative Land Uses**
  - **Topographic Profile Index**
  - **Number of Cattle**
  - **Proximity to Streams**

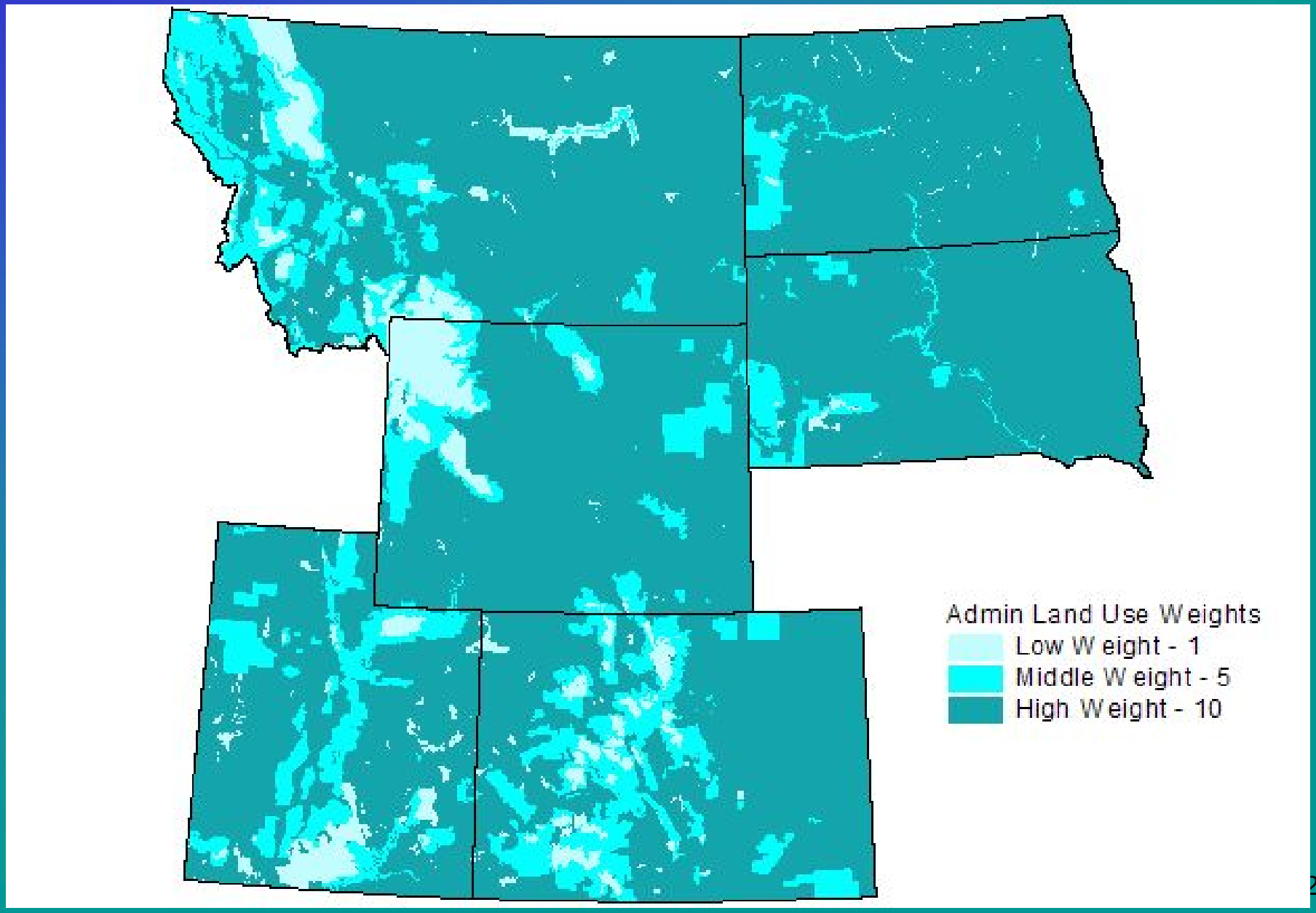
Cattle per Hectare in Region 8



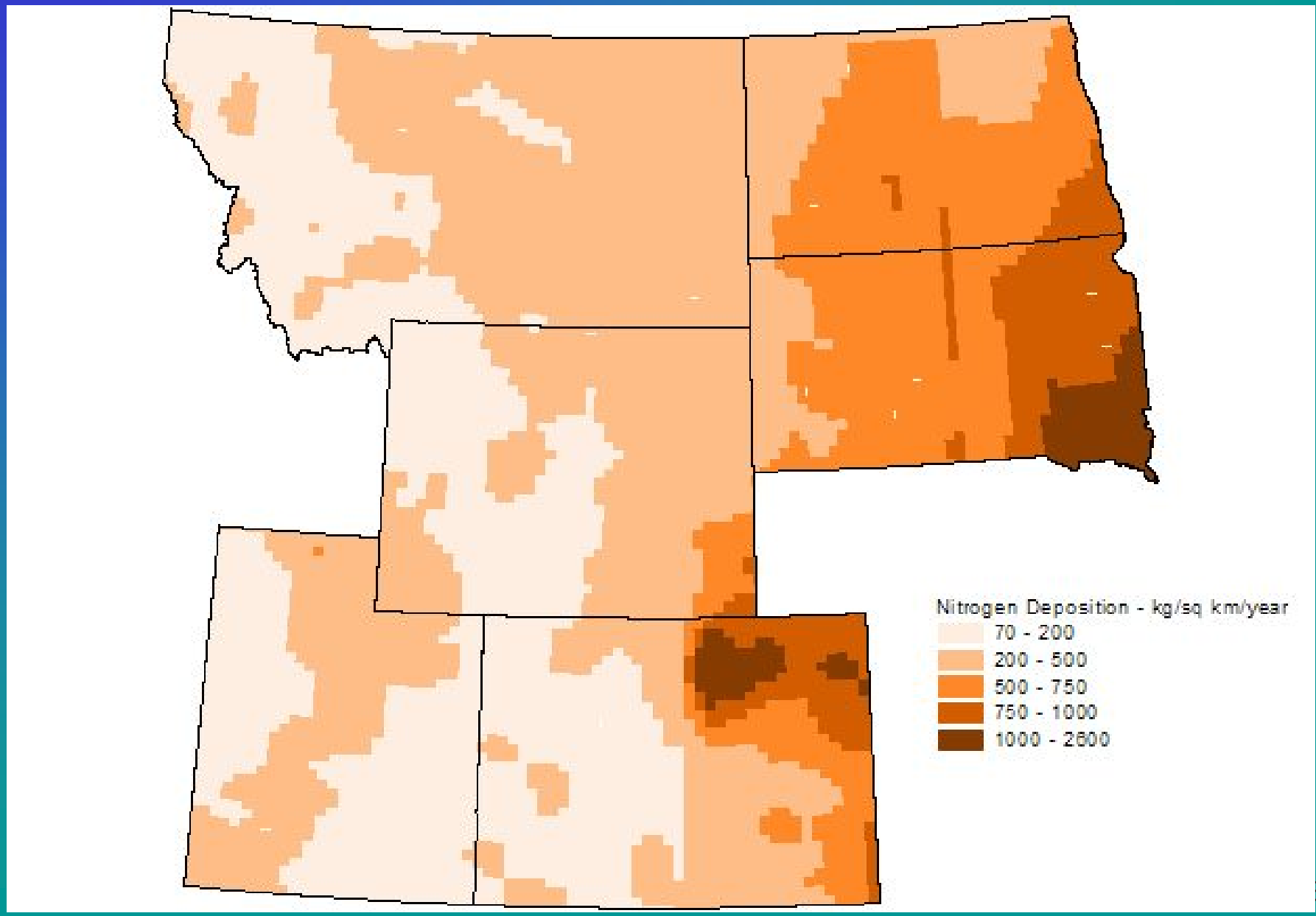
Montana – Land Cover Weighting for Grazing



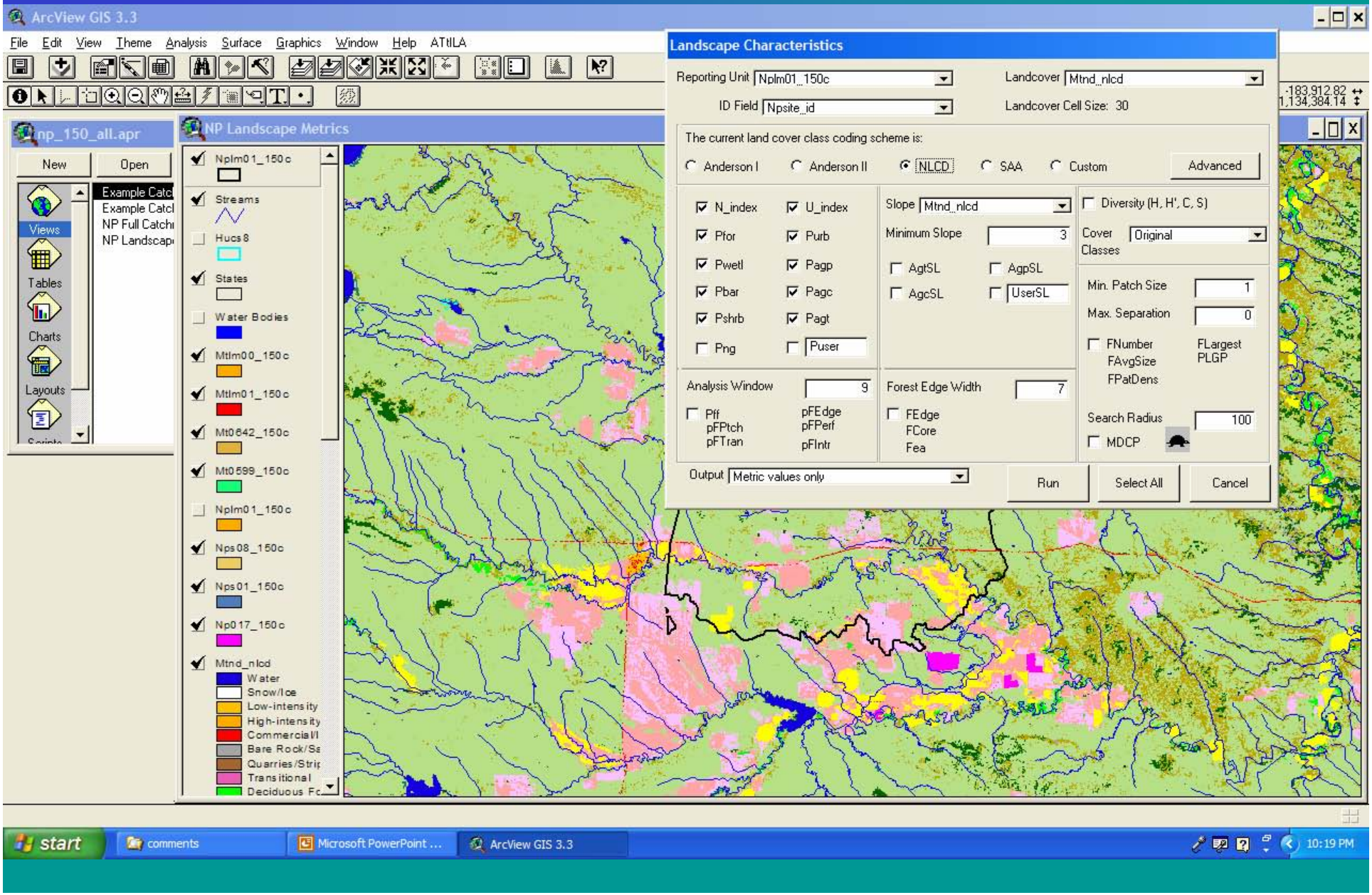
Administrative Land Use Weighting for Grazing



Nitrogen Deposition – kg / sq km / year



Landscape Metrics – ArcView ATtiLA



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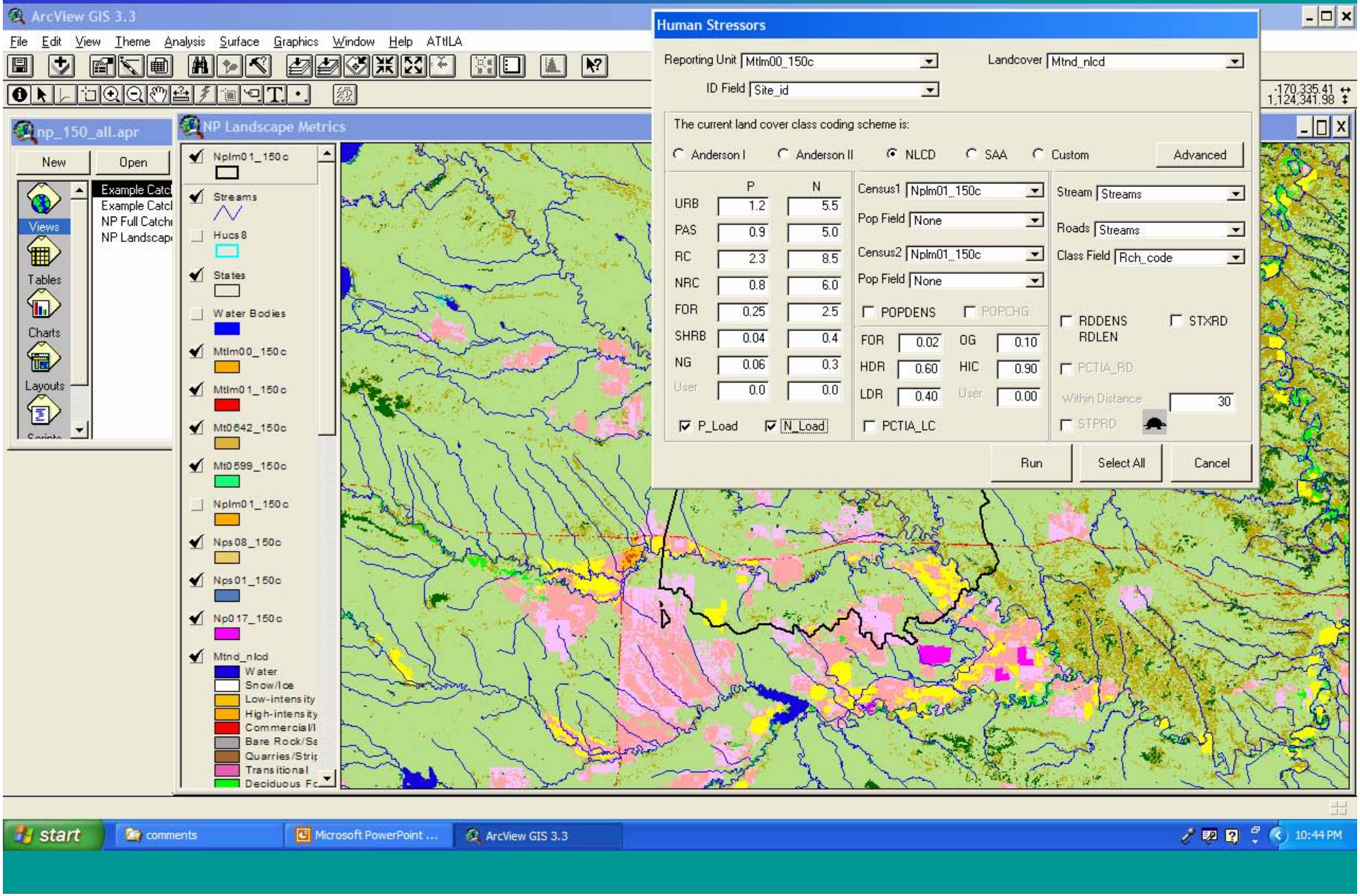
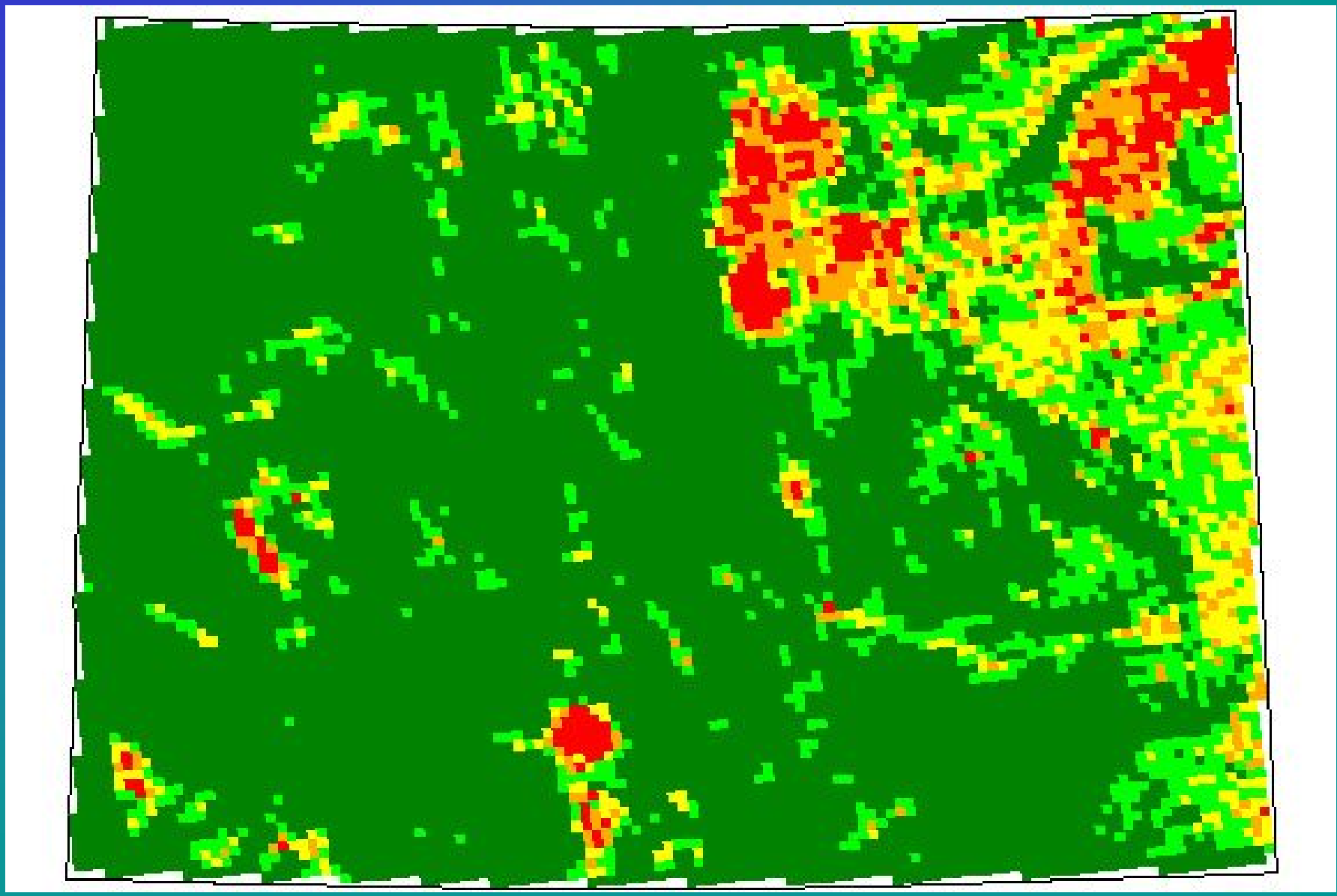


The Different Nutrient Landscape Indicator Models being examined

- **TN = *f* (NLOAD + Grazing Impact + Nit Dep)**
- **TN = *f* (NLOAD + Grazing Impact + Nit Dep)**
  - **with NLOAD derived from modified NLCD**
- **TN = *f* (U_INDEX + Grazing Impact + Nit Dep)**

- **TP = *f* (PLOAD + Grazing Impact)**
- **TP = *f* (PLOAD + Grazing Impact)**
  - **with PLOAD derived from modified NLCD**
- **TP = *f* (U_INDEX + Grazing Impact)**

Colorado – Potential Phosphorus (based only on land cover)



DRAFT

Yellow, orange, red – greater than 0.1 mg/L

Questions / Comments?